Introduction to 3D Printing

What is a 3D Printer

A machine that creates a three-dimensional object from a digital file by stacking thin, two-dimensional layers of material. This machine usually reads g-code files that give it specific instructions on how to print an object.

3D Designs

3D models are created using 3D modeling software, usually referred to as CAD (computer-aided design) software. Here is a list of a few free options to check out for making designs:

Blender (free)
SketchUp (free)
Tinkercad (free)
Vectary (free)

Designing a 3D model can be difficult for beginning printers. Free 3D models are also available online through several repositories. These repositories allow users to download .stl files for a variety of designs from bolts to figurines. Here are a few sample ones:

Printables (https://www.printables.com/)
Thingiverse (all free) (https://www.thingiverse.com/)
MyMiniFactory (many free and some paid) (https://www.myminifactory.com/)
Cults3D (free and paid) (https://cults3d.com/en)

3D Printing Software

3D models need to be prepared for 3D printing using a special kind of software that translates the model into machine instructions. This is done using slicing software. 3D models are imported into a slicer, which then virtually "slices" the model into layers. The resulting files consist of G-code, which is essentially a long list of instructions followed by the 3D printer to build the model. Here are a few sample software that are free to use:

Prusa Slicer (free)
Ultimaker Cura (free and open source)

Terms:

Infill/ Fill Density - a measure of how much material will be printed inside the outer shell of the object. The higher percentage of infill selected the more dense (heavier) a printed design will be and the longer it will take to print.

Brim - a brim is a layer or layers of extruded filament that is used to stabilize small parts or islands on a printed object. A brim helps these areas to adhere to the print bed.

Supports - A layer or layers of extruded thermoplastic that is used to support overhangs on a design. Support structures are usually removed after printing is completed.

Extruder – the part of the machine that handles feeding and extruding filament during a print. The extruder has two parts: the stepper motor and feeding system that pushes the material into the printer, and a hot end that heats and extrudes the material through a nozzle onto the print bed.

Print Bed - the surface where the printer deposits the materials used for printing

Gcode – the coding language that the 3D printer understands. It is used to transmit instructions to a 3D printer's control system to tell the printer how to print the 3D model.

Stl file - A 3d file format used by CAD programs that describes surface geometry of a 3D object without any colour, texture or other attributes.

PLA – is short for Polylactic Acid. PLA, or Polylactic Acid, is a biodegradable, environmentally friendly thermoplastic that is manufactured out of natural substances, usually corn or sugarcane. PLA prints at relatively lower temperatures than other printing materials (180C – 210C).